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Course Name

Automation, Instrumentation, Measurements, and Process Control

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Sector Name

Instrumentation & Controls

Document Type

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Automation, Instrumentation, Measurements, and Process Control

Course Introduction

The control of processes in today's world requires accurate knowledge of process conditions, and this, in turn, means accurate measurement of those conditions. Without measurement, there can be no control and no information as to the state of the process. A greater understanding of the measuring equipment and the instruments can improve the performance of the operator, and this, in turn, will improve plant performance.

The principles behind the selection

Better knowledge of how equipment is selected and how it is constructed, and how it works also helps an operator to identify the cause of problems and prevent their Recurrence. Hence, the economic benefits of properly trained and informed operators can be readily quantified. It is suitable for operators. Describes the major types of measuring and control instruments and equipment that are used. Describes the principles behind the selection, construction, and operation of process measurement and control equipment. Builds on the existing knowledge of process operators.

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Target Audience

✓ Control & Instrumentation Engineer
✓ Controls Technologist
✓ Instrumentation Technician / Systems Control Tech
✓ Senior Control & Instrumentation Engineer
✓ Maintaining Equipment Engineer
✓ Facilities I&E / Controls Engineer
✓ Offshore Instrumentation Engineer

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Learning Objectives

- ✓ Specify and design instrumentation systems for pressure, level, temperature, and flow.
- ✓ Identify a large number of industrial analytical measuring instruments.
- ✓ Describe the construction and operation of the most important analytical instruments.
- ✓ Be able to conduct the following types of measurement: pH, conductivity, turbidity, hygrometry, dissolved oxygen, total free chlorine, and online chromatography.
- ✓ Implement procedures for testing and calibration of analytical instruments.
- ✓ Correctly select and size control valves for any particular application.
- ✓ Troubleshoot and identify problems with instrumentation systems.
- ✓ Isolate control loops and identify a faulty instrument.

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Course Outline

✓ 01 Day One

Module (01) Introduction to Process Measurement

- ✓ Basic measurement concepts
- ✓ Measuring instruments.
- ✓ Introduction to control valves.
- ✓ Pressure, level, temperature, and flow principles.
- ✓ Identification and symbol
- ✓ Piping & Instrumentation Diagram P&ID
- ✓ Loop Diagram
- ✓ Wiring Diagram

Module (02) Pressure Measurement

- ✓ Principles of pressure measurement
- ✓ Units of pressure.
- ✓ Pressure measuring transducer
- ✓ Installation considerations
- ✓ A pressure control loop (block diagram)
- ✓ Practical work (simulation software)

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Course Outline

✓ 02 Day Two

Module (03) Level Measurement

- ✓ Principles of level measurement
- ✓ Sight glasses and tape measuring systems.
- ✓ Hydrostatic pressure for level measurement
- ✓ Ultrasonic level measuring techniques.
- ✓ Measurement of density
- ✓ Installation considerations.
- ✓ Level control loop (block diagram)
- ✓ Practical work (simulation software)

Module (04) Temperature Measurement

- ✓ Principles of temperature measurement
- ✓ Thermocouples and thermocouple tables.
- ✓ Resistance temperature detectors (RTDs)
- ✓ Thermometers, liquid in glass, filled and bi-metallic strip.
- ✓ Pyrometers.
- ✓ Installation considerations.
- ✓ Temperature control loop (block diagram)

Module (05) Flow Measurement

- ✓ Principles of flow measurement.
- ✓ Mass flow measuring instruments
- ✓ Positive displacement measuring instruments.
- ✓ Oscillatory flow measurement
- ✓ Flow measurement for custody transfer or fiscal purposes.
- ✓ Future developments.

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Course Outline

✓ 03 Day Three

Module (06) Control Valves

- ✓ Principles of control valves
- ✓ Types of control valves: Globe, butterfly, ball, and cage valves.
- ✓ Control valve flow characteristics.
- ✓ Noise and cavitation in control valves.
- ✓ Actuators and positioners.
- ✓ Valve testing (stroke testing).
- ✓ Mounting a positioner and calibrating (procedure)
- ✓ Future developments
- ✓ Practical work (simulation software)

Module (07) Process Considerations

- ✓ Transmitters for each of the process variables
- ✓ Smart transmitters
- ✓ Testing a control loop for each of the process variables.
- ✓ Practical work (workshop)

Module (08) Transmission of Measurement Signals

- ✓ Concept of a loop and feedback system.

- ✓ The 3 – 15 psi control loop
- ✓ The 4 – 20 mA control loop
- ✓ Digital transmission
- ✓ The control room

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✓ 04 Day Four

Module (09) Basic Control Concepts

- ✓ Manual control
- ✓ Feedback control and feed-forward control
- ✓ Simple on-off control
- ✓ On-off control with a differential gap
- ✓ Proportional control
- ✓ Integral control
- ✓ Proportional plus integral control
- ✓ Derivative control
- ✓ Proportional plus integral plus derivative control
- ✓ Tuning a control loop
- ✓ The quarter-wave decay reaction method
- ✓ Ziegler-Nichols method (ultimate proportional band and ultimate gain)
- ✓ Stability of a control system

Module (10) Complex Control Systems

- ✓ Cascade control
- ✓ Ratio control
- ✓ Split range control
- ✓ Adaptive control

- ✓ Tuning a cascade control loop
- ✓ Tuning a ratio control loop

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Course Outline

✓ 05 Day Five

Module (11) Computer Control Systems

- ✓ Analogue signals
- ✓ Digital signals
- ✓ Direct digital control
- ✓ Analogue/digital conversion
- ✓ Digital/analogue conversion
- ✓ The distributed control system (DCS)
- ✓ The "control cell"
- ✓ The Programmable Logic Controller

Module (12) Networks

- ✓ Ring, star and multi-drop networks
- ✓ Network Topologies
- ✓ Collision detection and avoidance
- ✓ Token passing network
- ✓ RS-232 C 12.6 Fieldbus protocol
- ✓ Modbus protocol

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
March 15, 2027	March 19, 2027	5 days	4950.00 $	Austria , Vienna
April 11, 2027	April 15, 2027	5 days	4250.00 $	Qatar , Doha
Dec. 21, 2026	Dec. 25, 2026	5 days	4250.00 $	UAE , Dubai
Oct. 4, 2027	Oct. 8, 2027	5 days	4250.00 $	UAE , Abu Dhabi

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